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ENERGY CONSERVATION AUDIT

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Abstract

This study presents an energy conservation audit conducted at a polytechnic college campus to evaluate energy consumption patterns and identify opportunities for energy savings. The audit includes analysis of electrical loads such as lighting systems, ceiling fans, computers, laboratory equipment, AC/DC machines, workshop machines, inverter systems, borewell pump, and lift. The total connected load of the campus is found to be 47.65 kW, with a daily energy consumption of 238.25 kWh and monthly consumption of 6194.5 kWh. The study highlights major energy-consuming areas and identifies inefficiencies in equipment usage and operational practices. Various energy conservation measures such as the use of LED lighting, energy-efficient motors, proper scheduling, and automation are suggested. The implementation of these measures can reduce energy consumption by 20–30%, resulting in significant cost savings and environmental benefits. This audit demonstrates the importance of systematic energy management in educational institutions.

INTRODUCTION

Energy plays a vital role in the development of any educational institution. Colleges consume a large amount of electrical energy for lighting, ventilation, laboratories, workshops, and other facilities. Due to increasing energy demand and rising electricity costs, it is essential to use energy efficiently.

An energy conservation audit is a systematic approach to analyze energy consumption, identify wastage, and recommend suitable measures for energy saving. In educational institutions, energy audits help in reducing electricity bills and improving overall efficiency.

This study focuses on conducting an energy audit of a polytechnic college campus to evaluate energy consumption and suggest improvements for sustainable energy management.

2. OBJECTIVES

- To calculate total electrical load of the college
- To analyze energy consumption patterns
- To identify major energy-consuming equipment
- To detect energy wastage areas
- To suggest energy conservation measures
- To reduce electricity cost and improve efficiency

The purpose of this system is:

- To enhance industrial safety by detecting hazards early
- To reduce human effort through automation
- To provide real-time monitoring of industrial parameters
- To send instant alerts using GSM/Wi-Fi
- To improve productivity and reduce machine downtime

3. METHODOLOGY

The methodology adopted for this study includes:

- Collection of data related to electrical equipment
- Measurement of load based on quantity and power rating
- Calculation of total connected load
- Estimation of daily and monthly energy consumption
- Identification of energy wastage
- Suggestion of energy-saving techniques

4. LOAD CALCULATION SUMMARY (Short for Paper)

Equipment	Load (kW)
Lighting	1.0
Fans	3.15
Computers	10
Lab Equipment	5
AC/DC Machines	7.5
Workshop Machines	10
Inverter	3
Borewell Pump	3
Lift	5

5. RESULTS AND DISCUSSION

The energy conservation audit carried out for the college campus provides a comprehensive analysis of electrical load distribution and energy consumption patterns. The study considered major electrical loads including lighting systems, ceiling fans, computers, laboratory equipment, AC/DC machines, workshop machines, inverter systems, borewell pump, and lift.

The **total connected load** of the campus is calculated as **47.65 kW**. Based on the average operating duration of 5 hours per day, the **daily energy consumption** is estimated to be **238.25 kWh/day**, while the **monthly energy consumption** is approximately **6194.5 kWh**.

The analysis of load distribution reveals that **workshop machines (10 kW), computers (10 kW), and AC/DC machines (7.5 kW)** are the major contributors to the total energy consumption. These loads together account for a significant portion of the overall demand, indicating that laboratories and workshops are the most energy-intensive areas of the campus.

In addition, **fans and lighting systems**, although having lower individual ratings, contribute substantially due to their continuous operation throughout the day. It was observed that inefficient usage practices such as leaving lights and fans ON in unoccupied rooms, idle running of machines, and lack of proper scheduling increase unnecessary energy consumption.

The audit also identified that the use of **conventional equipment**, such as older fans and fluorescent lighting, results in higher energy losses compared to modern energy-efficient alternatives. Furthermore, the absence of automated control systems leads to poor energy management.

By implementing appropriate energy conservation measures such as:

- Replacement of conventional lighting with LED systems
- Use of energy-efficient motors and BLDC fans
- Proper scheduling and controlled operation of workshop machines
- Installation of automatic control systems and sensors

the institution can achieve an estimated **energy saving potential of 20–30%**.

Thus, the results clearly indicate that significant energy savings can be achieved through improved energy management practices and adoption of efficient technologies, making the campus more sustainable and cost-effective.

6. CONCLUSION

The energy audit conducted for the college campus reveals that the total connected load is 47.65 kW with significant energy consumption in workshop machines, computers, and laboratory equipment. It is observed that improper usage and outdated equipment contribute to energy wastage.

By adopting energy-efficient technologies such as LED lighting, efficient motors, and improved operational practices, energy savings of up to 20–30% can be achieved. The study highlights the importance of energy management in educational institutions for cost reduction and environmental sustainability.

7. FUTURE SCOPE

- Installation of solar photovoltaic systems
- Implementation of smart energy monitoring systems
- Automation using sensors and IoT
- Periodic energy audits for continuous improvement

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